Capture Cavity 2 Update

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April 3rd

The CC2 Project

Capture Cavity 2 is a high gradient superconducting cavity destined to upgrade the Photoinjector to 40 MeV. This opportunity has been used for FNAL to learn the intricacies of SCRF work as well as to test FNAL facilities.

It is a collaborative effort:

- Tesla 9-Cell 1.3 GHz Cavity: DESY (33MV/m)
- Slow Tuner: Saclay & FNAL
- Cryo Vessel: IPN Orsay
- LLRF: DESY & FNAL
- Inside FNAL: AD, TD, CD

Calendar

Started Nov 2004

Approval for RF on Jan 17th (2006)

RF into Input Coupler Jan 17th

Coupler processing Jan 24th

Cool down Feb 6th (coupler still problematic)

Warm up Feb 16th

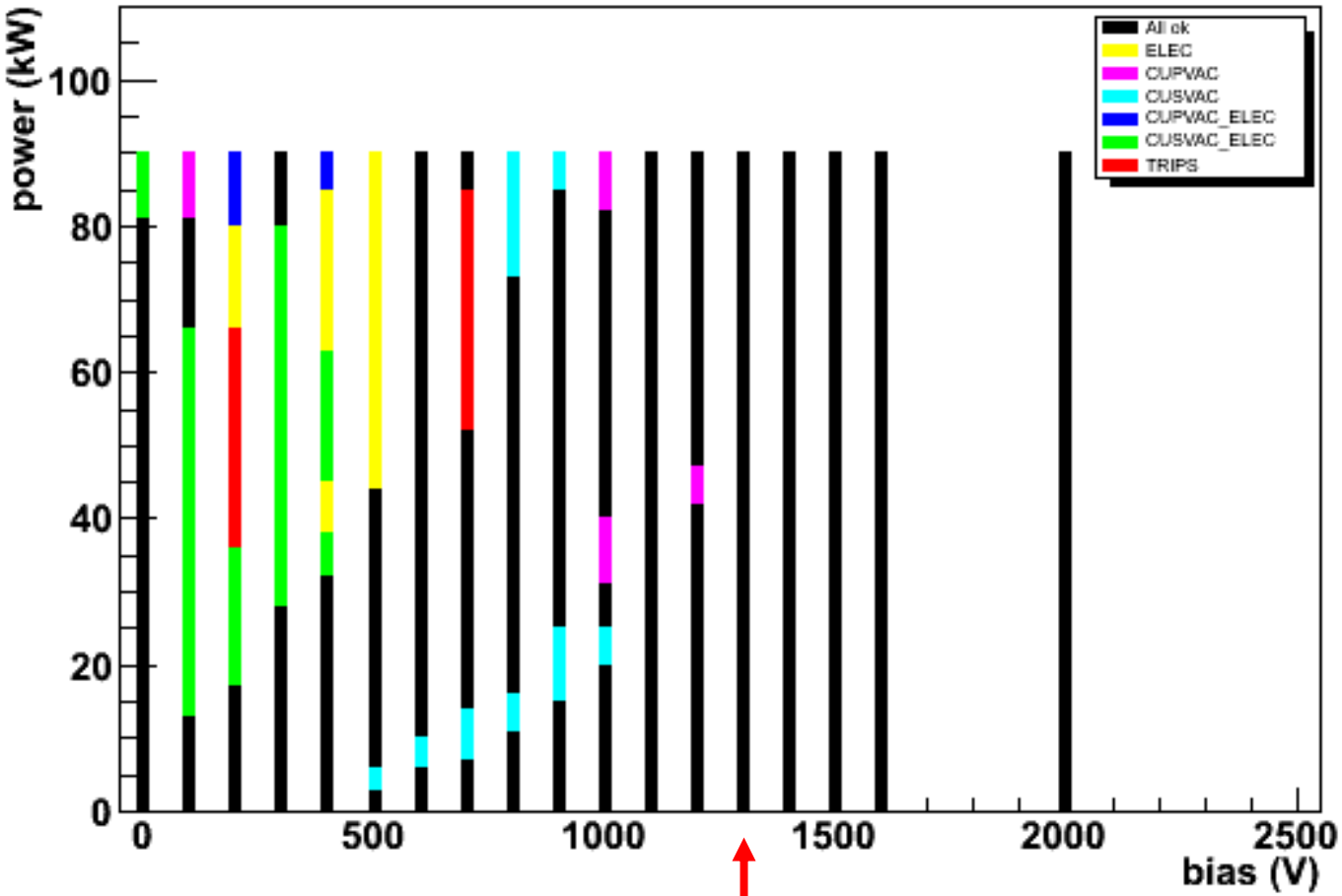
More Coupler Processing: Feb - March

2nd Cool Down March 13th

CC2 Testing: Gradients, Dark Current, LLRF, Piezo & More

Warm up to begin 1.8K Installation: March 29th

Understanding Input Coupler

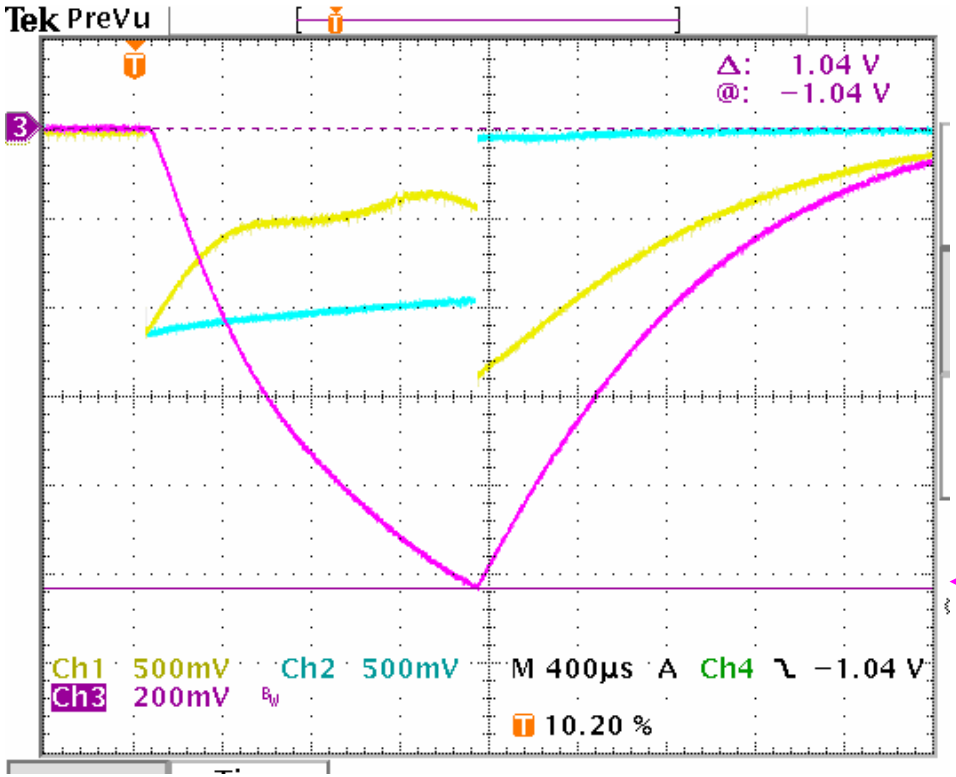


We are operating at a bias of +1300 V on center conductor.

RF In CC2: Peak Gradient

Driving with a 1.38mSec (~100kW) square RF pulse: “Full Blast”

Q-loaded: 4.28E6



BLU = P-forward

YEL = P-reflected

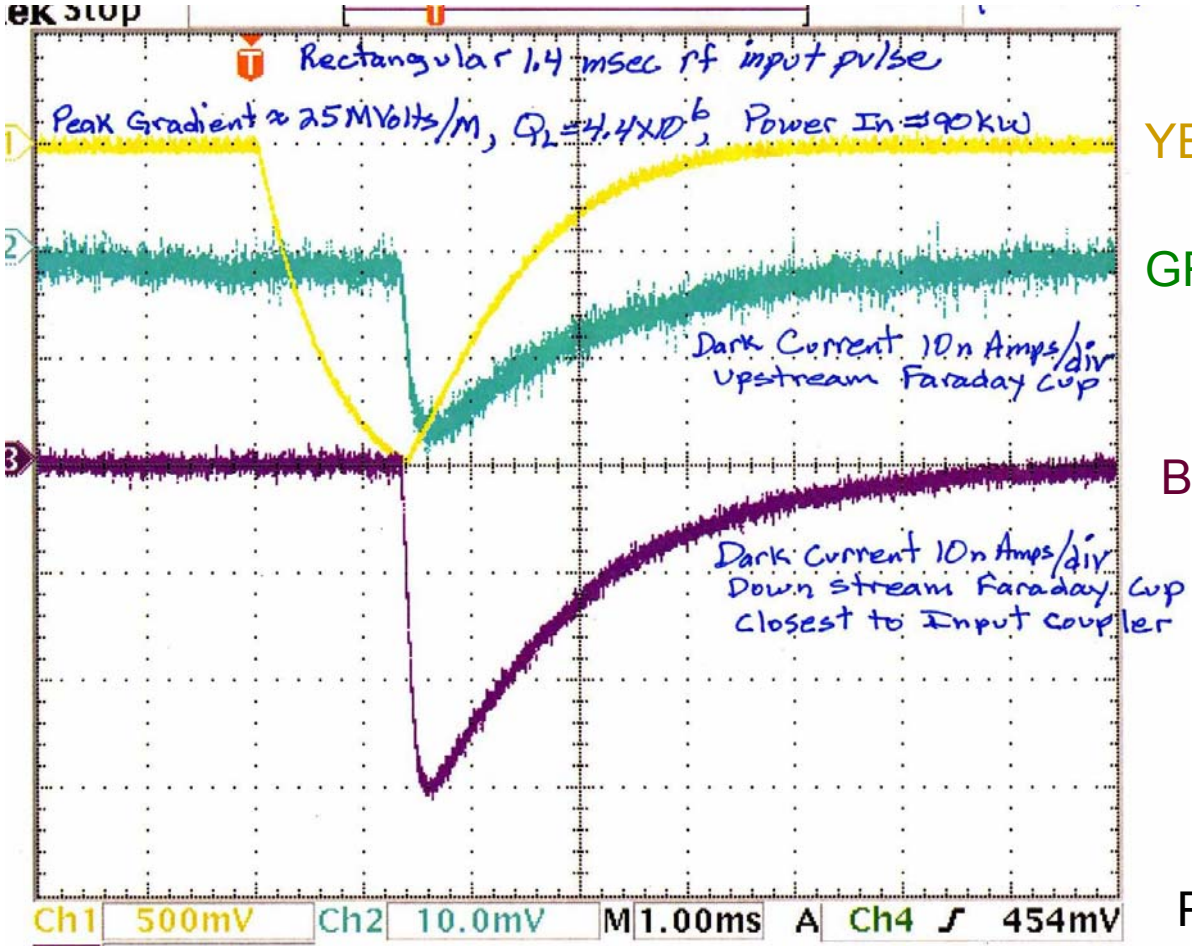
RED = P-trans = gradient

~ 28MV/m

(any higher in gradient and cavity displays quenching)

RF In CC2: Dark Current

A Faraday Cup is installed at both ends of CC2's beam pipe.



YEL = P-Trans = Gradient

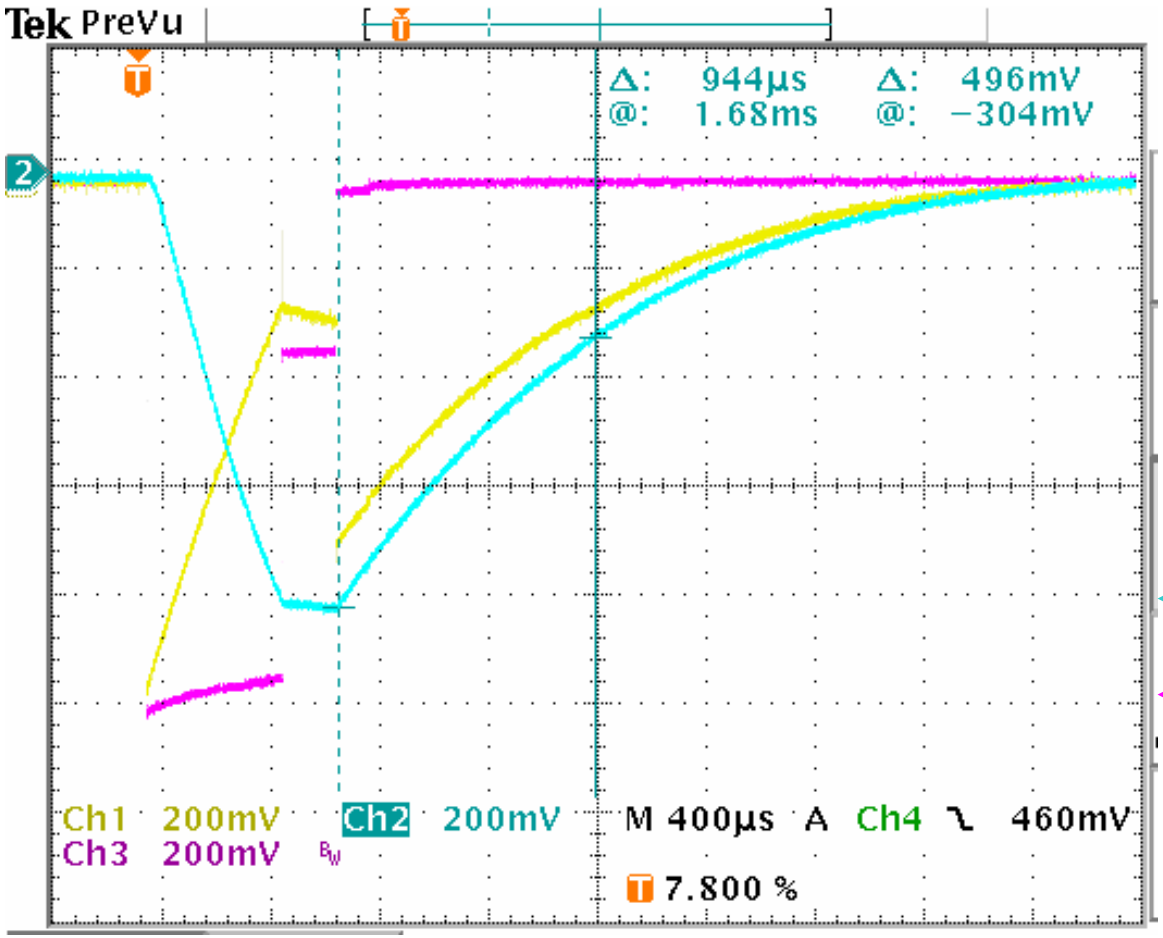
GRN = "Up Stream" Faraday Cup

BLU = "Dn Stream" Faraday Cup

Peak Dark Current: 50nAmps

RF In CC2: LLRF Control

Using DESY SimCon3.1 LLRF controller



BLU = P-Trans = Gradient

YEL = P-Ref

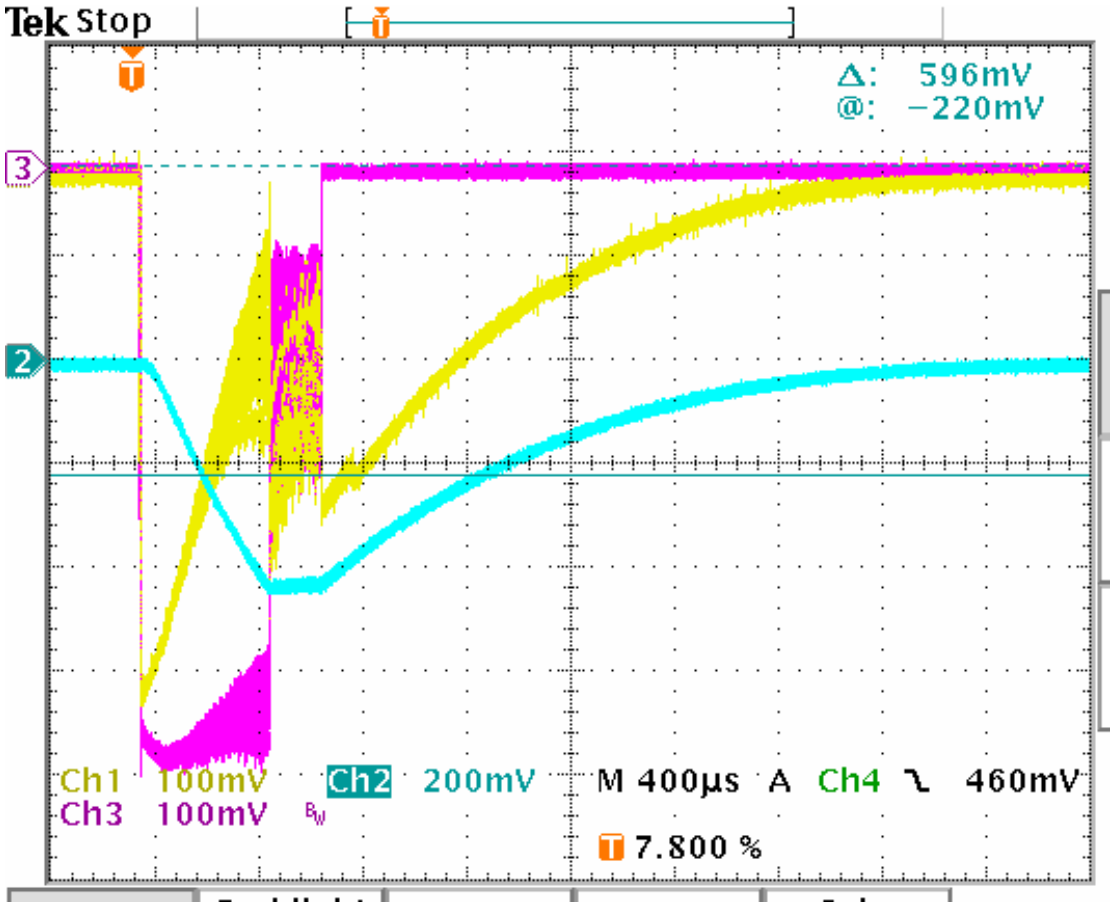
RED = P-Fwd

15MV/m

85kW

RF In CC2: LLRF Control

O’scope persistence set to 30 events:



BLU = P-Trans = Gradient

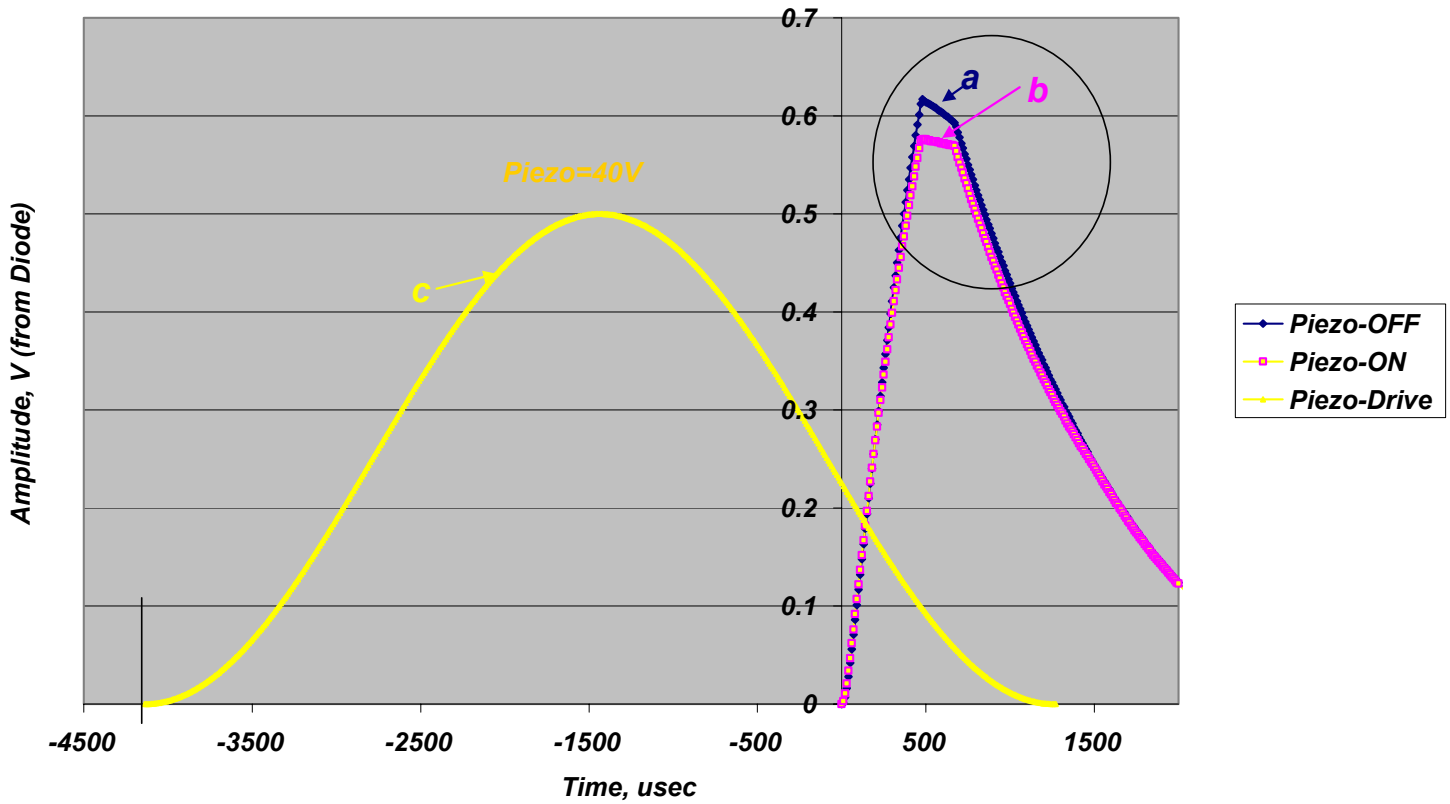
YEL = P-Ref

RED = P-Fwd

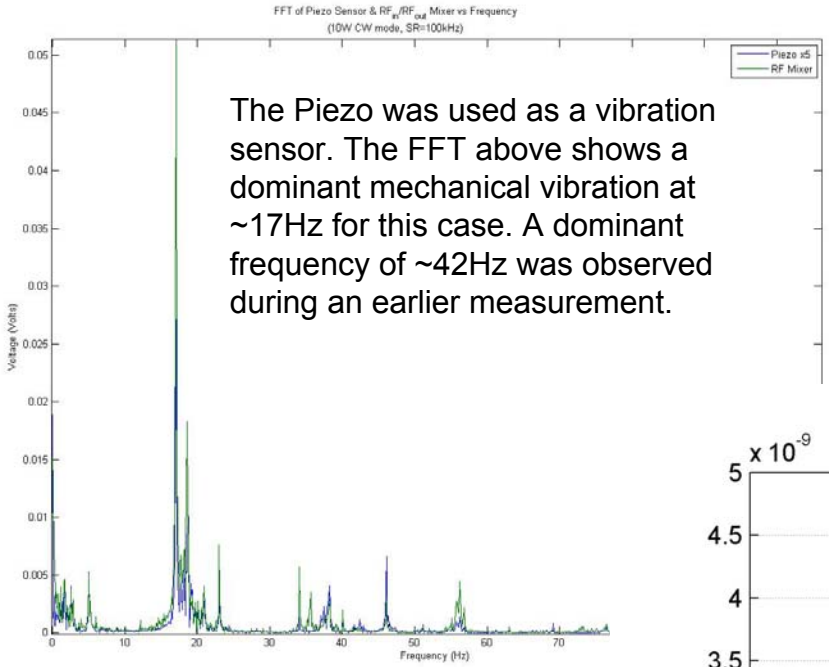
LLRF System compensated for frequency changes due to cryogenic pressure fluctuations.

RF In CC2: Piezo Fast Tuner

Lorentz force compensation with Piezo tuner
Piezo pulse: Single sine pulse; Vhv=40V ; F=185Hz= 5405usec; start 4140usec before cavity pulse



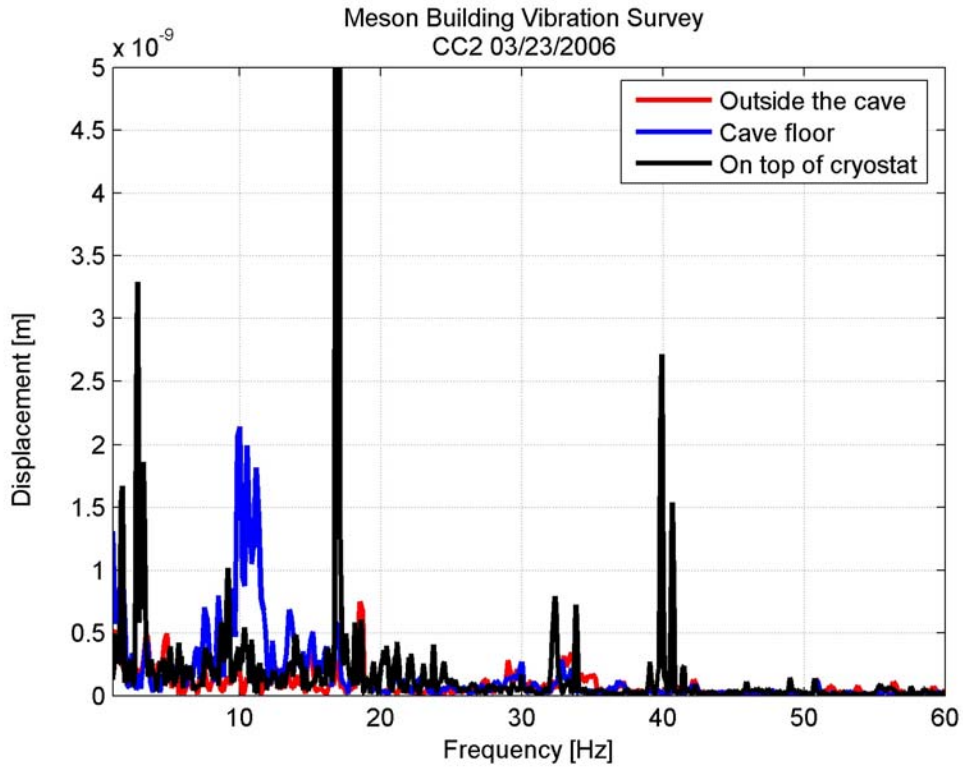
Vibration Studies



The Piezo was used as a vibration sensor. The FFT above shows a dominant mechanical vibration at ~17Hz for this case. A dominant frequency of ~42Hz was observed during an earlier measurement.

← From Piezo Element

From Seismometer →



Warm Up to Cool Down !

Warmed up CC2 last Wednesday (3/29) to allow Cryogenics Dept to prepare pumps for 1.8K operation.

1.8K in early May.